HEA-03-004-IP

The unreasonable effectiveness of the modulation spectrogram in psychophysics, physiology, and speech processing

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The current contribution tries to analyze why the concept of the modulation spectrogram has been successful so far and what are the essential properties of the concept. Specifically, the necessity of spectrotemporal processing is examined, i.e., the advantage of combining the modulation spectrum information across several frequency channels. It can be shown that the accuracy of speech representation increases significantly if across-frequency temporal information is used, e.g., when estimating the signal-to-noise ratio of a speech signal in nonspeech noise. Thus,, it can be hypothesized that spectrotemporal features are utilized in the brain for a robust internal representation of acoustical objects. This hypothesis should be tested both by psychoacoustical and physiological experiments.